



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

September 16, 2016

The Honorable Stephen G. Burns  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT:     REPORT ON THE SAFETY ASPECTS OF THE FLORIDA POWER & LIGHT  
                  COMPANY'S COMBINED LICENSE APPLICATION FOR TURKEY POINT  
                  UNITS 6 AND 7**

Dear Chairman Burns,

During the 636<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), September 8-10, 2016, we reviewed the Florida Power & Light Company (FPL or applicant) combined license application (COLA) for Turkey Point Units 6 and 7 and the NRC staff's advanced safety evaluation (ASE). FPL proposes to construct and operate two Westinghouse AP1000 reactors at their owned and controlled 9400-acre Turkey Point plant property, located in Miami-Dade County, Florida, approximately 25 miles south of Miami. Currently, the Turkey Point plant property includes five operating electric generating units: two oil/gas-fired units (Units 1 and 2), one gas-fired combined cycle unit (Unit 5), and two nuclear power units (Units 3 and 4). Both Units 3 and 4 are Westinghouse-designed pressurized water reactors. They entered commercial operation in 1972 and 1973, respectively.

Our AP1000 Subcommittee held a two-day meeting on August 18-19, 2016, to review the plant-specific information in the COLA and the staff's ASE. During this review, we had the benefit of discussions with representatives of the staff, FPL and its vendors, and input from members of the public. We also had the benefit of the referenced documents. This report fulfills the requirement of 10 CFR 52.87 that the ACRS report on those portions of the application which concern safety.

**CONCLUSIONS AND RECOMMENDATION**

1. There is reasonable assurance that Turkey Point Units 6 and 7 can be built and operated without undue risk to the health and safety of the public. The FPL COLA for these units should be approved.
2. The following proposed site-specific departures from the AP1000 design control document (DCD) should be approved.
  - a. Consolidation of the Technical Support Center (TSC) to provide support to Turkey Point Units 3, 4, 6, and 7.

- b. Meteorological exceedances for the operating basis wind speed and for the maximum safety and maximum normal wet bulb air temperatures.
  - c. Exclusion area boundary minimum distance.
3. Staff should consider if existing guidance for estimating future sea level rise and guidance for location of the TSC should be updated to reflect changing circumstances.

## **BACKGROUND**

By letter, dated June 30, 2009, FPL submitted a COLA to the NRC for Turkey Point Units 6 and 7, in accordance with the requirements of 10 CFR Part 52. In the application, FPL stated that these units would be two Westinghouse AP1000 advanced pressurized water reactors and they would be located at the existing Turkey Point site. The COLA incorporates the Westinghouse AP1000 certified design, the standard content material from the AP1000 reference combined license application (RCOLA), and the FPL site-specific information.

The design centered review approach is described in Regulatory Issue Summary 2006-06. The design centered review approach is Commission policy intended to promote standardization of COLAs beyond the scope of information included in the design certification. Specifically, this policy allows the staff to perform one technical review for each issue outside the scope of the design certification and it allows the decision based on this review to support multiple COLAs.

The first COLA submitted for NRC staff review is designated in a design center as the RCOLA, and the subsequent applications which reference the RCOLA are designated as subsequent combined license applications (SCOLAs). The Turkey Point Units 6 and 7 COLA is the fourth SCOLA referencing the AP1000 DCD and Vogtle RCOLA. It includes the same five AP1000 departure requests we first reviewed under the Levy docket and addressed in our letter report to the Commission, dated April 18, 2016.

FPL has organized and annotated its SCOLA to identify: a) sections that incorporate by reference the AP1000 DCD, b) sections that are standard for COLAs in the AP1000 RCOLA, and c) sections that are site-specific and thus only apply to Turkey Point Units 6 and 7.

## **DISCUSSION**

### Population Density

Regulatory Guide 4.7 includes a criterion for satisfying 10 CFR 100.21, relative to siting in an area of low population density. The guidance also includes provisions for determining site acceptability when the criterion is exceeded, provided that population density is not well in excess of the criterion. The low population density criterion is that within about five years of plant site approval, the population density, including weighted transient population, averaged over any radial distance out to 20 miles (cumulative population at a distance divided by the circular area at that distance), does not exceed 500 persons per square mile. Based on FPL's projection, this criterion is exceeded from 5 to 20 miles by about one-third.

Accordingly, FPL implemented the guidance provisions for determining site acceptability. This requires consideration of alternative sites with lower nearby population densities, while giving attention to safety, environmental, economic, and other factors. FPL found that the Turkey Point site offered advantages related to grid reliability, land availability, and existing nuclear plant and emergency planning infrastructure. Staff review concluded that regulatory guidance concerning population density had been met.

FPL stated that the exceedance of 500 persons per square mile by one-third was not considered to be well in excess of the low population density criterion, and it noted that Turkey Point meets all regulatory requirements and guidance for the exclusion area, low population zone, distance to the nearest population center, and for emergency planning. We agree that the exceedance of the 500 persons per square mile guidance is acceptable, particularly given that all other population-related siting requirements and guidance are met, and that consideration was given to alternative siting in accordance with 10 CFR 100.21(h).

### Sea Level Rise

Regulatory Guide 1.59 includes guidance for establishing the plant flooding design basis. For coastal sites, this requires determination of the sea level before any rise resulting from an event such as a hurricane or tsunami. NUREG/CR-7046 recommends a method for estimating the long-term rise in sea level, using applicable gage station data. Following this guidance, and extrapolating for an assumed plant life of 60 years, FPL established an event antecedent sea level one foot above the current level. This higher sea level then became the basis for additions due to tide, local sea anomalies, and external events applicable to the site.

As discussed in Section 2.4.5.4.4 of its ASE, the staff referred to the possibility of an accelerating rise in sea level during the plant life which might not be shown in the historical data. FPL noted that they had followed the applicable guidance and recommendations, and that margins existed not only in the one foot sea level rise they had established based on historical data, but also in the additions to this element of antecedent level such as the tide level assumed.

The rise in sea level over time is monitored and widely publicized, so that the potential for an accelerating rise resulting in an increase above the one foot allowance used by FPL can be recognized well before it occurs. If necessary due to accelerating rates of sea level rise, measures could be taken at the time they are apparent to ensure that the safety design basis of the plant is maintained. We expect that the Turkey Point Units 6 and 7 licensing basis will be explicit concerning the assumed sea level rise of one foot, and that the licensee will remain aware of recorded sea level rise so as to recognize the potential exceedance during the plant life.

Regarding forecasts of potential sea level rise acceleration, including those made by government agencies, the staff should review regulatory guidance generically to determine if such forecasts should be addressed in establishing an antecedent sea level for siting purposes, or whether continued reliance on extrapolation of historical data remains sufficient.

### Flooding Evaluations

The coastal location of the site requires the determination of probable maximum flooding levels to consider hurricane storm surge with wave run up, tsunamis, and local precipitation events. FPL determined the highest water elevation in the power block area due to a probable maximum local precipitation event to be 24.5 feet, and due to a probable maximum hurricane, with storm surge, to be 24.8 feet. The U.S. Army Corps of Engineers performed an independent study of the site for a storm with an annual frequency of  $1 \times 10^{-7}$  which yielded a result within 0.1 feet of this level.

On August 16, 1992, Hurricane Andrew caused severe flooding in the State of Florida. During Hurricane Andrew, rainfall totals of more than seven inches were recorded in southeastern Florida and the peak storm surge on the southeast Florida coast occurred near the time of high astronomical tide. FPL stated that the highest storm level in Biscayne Bay of 15.4 feet was observed during Hurricane Andrew approximately 10 miles from the site. FPL stated that the level was lower than this at the Turkey Point site.

FPL considered the historical record, geological evidence, and physical data to evaluate the probable maximum tsunami elevation at the site. The staff also performed an independent tsunami modeling assessment resulting in a surface water elevation of 14.1 feet, which is in good agreement with the applicant's value of 14.0 feet.

The plant design grade level for safety-related structures is 26 feet, which is above the highest water levels calculated for the potential events that could affect the site, and therefore is considered acceptable.

### Deep Well Injection

FPL proposes to dispose of Turkey Point Units 6 and 7 liquid radioactive waste by first combining it with other sources of plant liquid waste to achieve the dilution required for release in compliance with 10 CFR Part 20, Appendix B. The combined waste stream is then pumped into a saline underground aquifer using deep well injection, which is an established means widely used in the region for disposal of other forms of liquid waste. Disposal of liquid radioactive waste by discharge to an underground aquifer is an alternative to its release into surface waters. Accordingly, approval of the disposal procedure is required in accordance with 10 CFR 20.2002.

The deep well injection is into the saline aquifer more than 3,000 feet below the ground surface. This aquifer is separated from a brackish aquifer above by intermediate confining strata. The injection system design includes monthly sampling of separate monitoring wells to detect any leakage from the injection wells at depths above the saline aquifer.

Although the discharged waste is expected to remain in the saline aquifer, FPL analyzed the consequences of saline aquifer intrusion by the drilling of a well into the aquifer to withdraw water for agricultural use. Independently, the staff analyzed a scenario involving the full breach

of the confining strata above the saline aquifer, allowing waste to enter the higher zone at the nearest offsite location where a well is assumed to be withdrawing water. Both analyses used conservative assumptions relative to radioactive decay and further dilution of the radioactive waste, and relative to the resulting dose to the maximally exposed individual. The results comply with 10 CFR Part 50, Appendix I, and confirm that doses are below the design objectives.

In summary, the liquid radioactive waste release complies with requirements applicable to discharge to surface waters, although it will be discharged instead into an underground aquifer where it is expected to remain. If it were not to remain in the aquifer, either due to intrusion or to confinement failure, the consequences would remain below requirements applicable to a surface discharge. The applicant complied with the requirements of 10 CFR 20.2002 for seeking approval of this alternate method of radioactive waste disposal.

#### Consolidated Technical Support Center and Emergency Operations Facility

An emergency response facility departure from the AP1000 DCD provides for a common TSC for Units 3, 4, 6, and 7. The TSC is located in the Turkey Point Nuclear Training Building, which is outside of the protected areas between the control rooms for Units 3 and 4 and the control rooms for Units 6 and 7. This is estimated to increase the travel time between the TSC and the control room from two minutes for the single-unit TSC location for the AP1000 design to about 10 to 15 minutes for the common TSC location. This increase is considered acceptable based on the communications and data links that are provided and on the expected benefits of maintaining a single TSC.

Guidance concerning location of the TSC is included in NUREG-0696. Among other things, the guidance suggests a walking time from the TSC to the control room of two minutes. The standard review plan allows improvement in communication technology to increase this walking time significantly, as has been reflected in several licensing actions recently. The benefits of a consolidated TSC at a multi-unit site, using current communication technology appear to warrant updating NUREG-0696, and we recommend that the staff consider doing so.

The applicant is also seeking approval for the emergency operations facility (EOF) to be located in Miami, Florida, approximately 26 miles from the site, in an existing FPL General Office building which is currently supporting Turkey Point Units 3 and 4. The staff has proposed several inspections, tests, analyses, and acceptance criteria (ITAAC) to demonstrate the ability of the EOF to support an emergency condition at the Turkey Point site. Demonstration of compliance with these ITAAC will be completed prior to fuel loading. The distance from the Turkey Point site to the common EOF is not excessive.

#### Meteorological Departures

FPL determined that meteorological conditions at the site exceed those included in the AP1000 DCD for three parameters. The 50-year return period, 3-second gust at Turkey Point is 150 mph, which exceeds the DCD value of 145 mph. The maximum safety and normal wet bulb temperatures of approximately 87.4°F and 81.5°F, respectively, exceed the DCD values of 86.1°F and 80.1°F. These relatively small, site-specific meteorological exceedances were evaluated by FPL and the staff and found not to affect design functions or analysis methods of any structures, systems or components.

### Exclusion Area Boundary Distance Departure

The AP1000 DCD requires a distance from the plant to the exclusion area boundary of 0.5 miles. The minimum distance for Turkey Point Units 6 and 7 is 0.27 miles, and this shorter distance has been reflected in the calculation of accident doses at the boundary. As discussed in Section 2.3.4.6 of the ASE, using atmospheric dispersion parameters appropriate to the shorter distance, the results are found to be acceptable.

### **SUMMARY**

The applicant and the staff have addressed the plant-specific requirements necessary for approval of the SCOLA. This includes DCD departures concerning the site-specific meteorology, exclusion area boundary minimum distance and the location of the TSC. The SCOLA for Turkey Point Units 6 and 7 should be approved.

Sincerely,

*/RA/*

Dennis C. Bley  
Chairman

### **REFERENCES**

1. Florida Power & Light Company, "Application for Combined License for Turkey Point Units 6 and 7," June 30, 2009 (ML091830589).
2. U.S. Nuclear Regulatory Commission, Regulatory Issue Summary 2006-06, "New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach," May 31, 2006 (ML053540251).
3. Advisory Committee on Reactor Safeguards, "Exemptions to the AP1000 Certified Design Included in the Levy Nuclear Plant Units 1 and 2 Combined License Application," April 18, 2016 (ML16102A149).
4. U.S. Nuclear Regulatory Commission, Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Revision 2, April 1998 (ML003739894).
5. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.59, "Design Basis Floods for Nuclear Power Plants," Revision 2, August, 1977 (ML003740388).
6. U.S. Nuclear Regulatory Commission, NUREG/CR-7046, "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America," November 2011 (ML11321A195).
7. U.S. Nuclear Regulatory Commission, NUREG-0696, "Functional Criteria for Emergency Response Facilities," February 1981 (ML051390358).

8. U.S. Nuclear Regulatory Commission, "Turkey Point Units 6 and 7 Combined License Application – Advanced Safety Evaluation without Open Items for Chapter 1 through 21"

ASE Chapter	Issuance Date	ML#s
1	7-14-2016	ML14349A710
2	7-14-2016	ML15096A254
3	7-12-2016	ML15096A264
4	7-12-2016	ML12202A833
5	7-12-2016	ML16159A198
6	7-12-2016	ML16117A527
7	7-12-2016	ML16159A234
8	7-12-2016	ML15096A344
9	7-12-2016	ML15096A428
10	7-12-2016	ML12262A056
11	5-17-2016	ML15096A457
12	7-12-2016	ML16161A380
13	7-12-2016	ML16061A443
14	7-12-2016	ML16161A384
15	7-12-2016	ML16166A272
16	7-12-2016	ML16161A359
17	7-12-2016	ML12262A238
18	7-12-2016	ML12262A247
19	7-14-2016	ML12262A277
19.A	7-14-2016	ML12262A286
20	5-17-2016	ML16062A258
21	7-14-2016	ML16137A481

1. U.S. Nuclear Regulatory Commission, "Turkey Point Units 6 and 7 Combined License Application – Advanced Safety Evaluation without Open Items for Chapter 1 through 21"

ASE Chapter	Issuance Date	ML#s
1	7-14-2016	ML14349A710
2	7-14-2016	ML15096A254
3	7-12-2016	ML15096A264
4	7-12-2016	ML12202A833
5	7-12-2016	ML16159A198
6	7-12-2016	ML16117A527
7	7-12-2016	ML16159A234
8	7-12-2016	ML15096A344
9	7-12-2016	ML15096A428
10	7-12-2016	ML12262A056
11	5-17-2016	ML15096A457
12	7-12-2016	ML16161A380
13	7-12-2016	ML16061A443
14	7-12-2016	ML16161A384
15	7-12-2016	ML16166A272
16	7-12-2016	ML16161A359
17	7-12-2016	ML12262A238
18	7-12-2016	ML12262A247
19	7-14-2016	ML12262A277
19.A	7-14-2016	ML12262A286
20	5-17-2016	ML16062A258
21	7-14-2016	ML16137A481

Accession No: **ML16257A535**

Publicly Available **Y**

Sensitive **N**

Viewing Rights:  NRC Users or  ACRS Only or  See Restricted distribution

<b>OFFICE</b>	ACRS	SUNSI Review	ACRS	ACRS	ACRS
<b>NAME</b>	PWen	PWen	MLBanks	ADVeil/MLB	ADV/MLB for DCB
<b>DATE</b>	09/19/16	09/19/16	09/19/16	09/19/16	09/19/16

**OFFICIAL RECORD COPY**